NEC's L TO Ku BAND LOW NOISE AMPLIFIER N-CHANNEL GaAS MESFET

NE67400 NE67483B

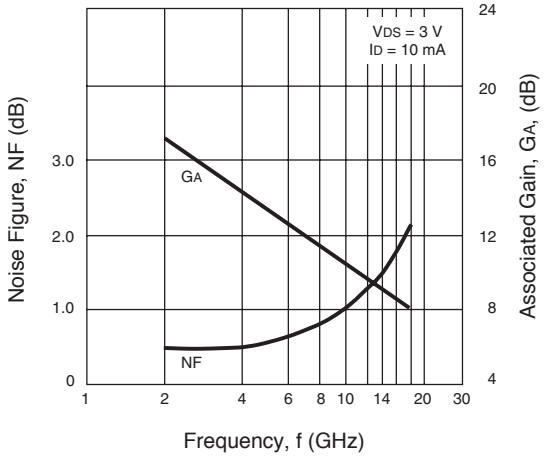
FEATURES

- **LOW NOISE FIGURE:** NF = 1.4 dB TYP at f = at 12 GHz
- **HIGH ASSOCIATED GAIN:** G_A = 10 dB TYP at f = 12 GHz
- **GATE WIDTH:** W_G = 280 μm
- **GATE LENGTH:** L_G = 0.3 μm

DESCRIPTION

NEC's NE674 is a L to Ku Band low noise GaAs MESFET. This device features a low noise figure with high associated gain, employing a recessed 0.3 micron gate and triple epitaxial technology. The active area of the chip is covered with SiD_2 and Si_3N_4 for scratch protection and surface stability. This device is suitable for both amplifier and oscillator applications. This device is housed in a solder sealed hermetic, metal ceramic package for high reliability in space applications.

NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY



ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE				NE67400 NE67483B		
SYMBOLS	**PARAMETERS AND CONDITIONS**		**UNITS**	**MIN**	**TYP**	**MAX**
NF	Noise Figure at V_{DS} = 3 V, I_D = 10 mA, f = 4 GHz f = 12 GHz		dB dB		0.6 1.4	 1.6
G_A	Associated Gain at V_{DS} = 3 V I_D = 10 mA, f = 4 GHz f = 12 GHz		dB dB	 8.5	14.0 10.0	
P_{1dB}	Output Power at 1 dB Gain Compression Point, f = 12 GHz, V_{DS} = 3 V, I_{DS} = 30 mA		dBm		14.5	
I_{DSS}	Saturated Drain Current at V_{DS} = 3 V, V_{GS} = 0 V		mA	20	40	120
$V_{GS(OFF)}$	Gate to Source Cut Off Voltage at V_{DS} = 3 V, I_D = 100 μA		V	-0.5	-1.1	-3.5
g_m	Transconductance at V_{DS} = 3 V, I_D = 10 mA		mS	20	50	100
I_{GSO}	Gate to Source Leakage Current at V_{GS} = -5 V		μA		1.0	10
$R_{TH\ (CH-C)}$	Thermal Resistance (Channel-to-Case)	NE67400	°C/W			190
		NE67483B	°C/W			450

ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DS}	Drain to Source Voltage	V	5.0
V_{GD}	Gate to Drain Voltage	V	–6.0
I_{DS}	Drain Current	mA	I_{DSS}
T_{CH}	Channel Temperature	°C	175
T_{STG}	Storage Temperature	°C	-65 to +175
P_T	Total Power Dissipation NE67483B NE67400	 mW mW	 270 400

Note:
1. Operation in excess of any one of these conditions may result in permanent damage.

RECOMMENDED OPERATING CONDITIONS (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V_{DS}	Drain to Source Voltage	V		3	4
I_D	Drain Current	mA		10	30
P_{IN}	Input Power	dBm			15

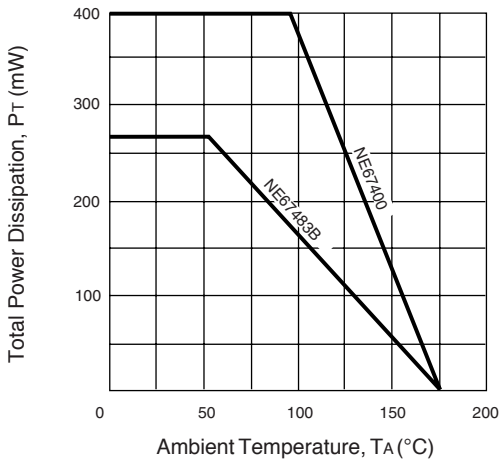
TYPICAL NOISE PARAMETERS (T_A = 25°C)

V_{DS} = 3 V, I_{DS} = 10 mA (NE67483B)

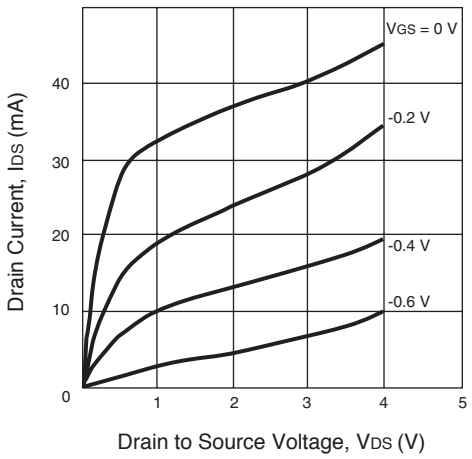
FREQ. (GHz)	NF_{OPT} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
2	0.55	17.0	0.81	37	0.57
3	0.58	15.2	0.75	53	0.51
4	0.60	14.0	0.70	69	0.44
5	0.68	13.2	0.67	83	0.37
6	0.76	12.6	0.65	97	0.31
7	0.85	12.0	0.64	111	0.25
8	0.93	11.5	0.64	123	0.19
9	1.03	11.0	0.64	136	0.14
10	1.15	10.7	0.64	148	0.10
11	1.26	10.3	0.64	161	0.06
12	1.40	10.0	0.63	173	0.05
13	1.55	9.6	0.62	-173	0.05
14	1.70	9.2	0.60	-159	0.08
15	1.84	9.0	0.57	-145	0.15
16	2.04	8.6	0.53	-129	0.23
17	2.18	8.3	0.46	-113	0.34
18	2.35	8.0	0.38	-95	0.44

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE

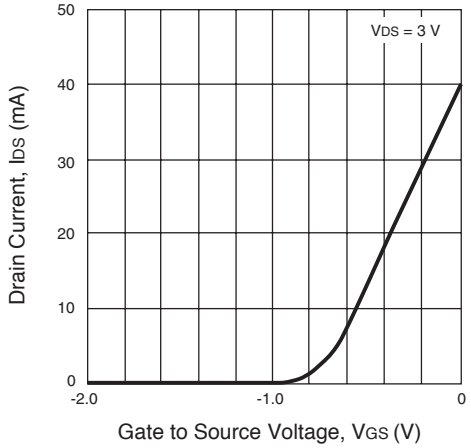


DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



TYPICAL PERFORMANCE CURVES (T_A = 25°C)

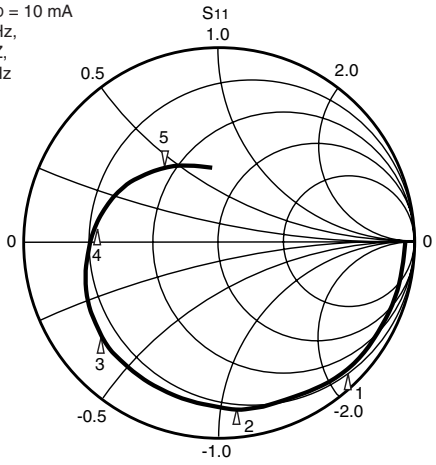
DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE

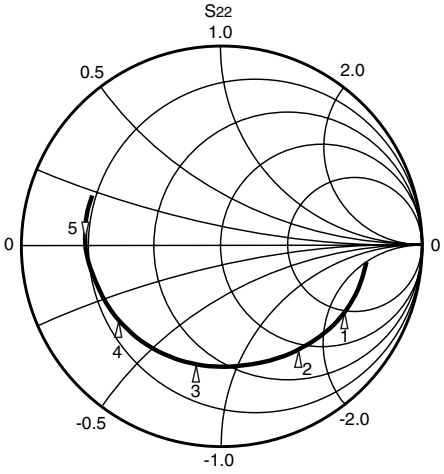


TYPICAL COMMON SOURCE SCATTERING PARAMETERS (T_A = 25°C)

NE67483B

V_{DS} = 3 V, I_D = 10 mA
Start 500 MHz,
Stop 18 GHZ,
Step 500 MHz





Marker
1 : 2 GHz
2 : 4 GHz
3 : 8 GHz
4 : 12 GHz
5 : 16 GHz

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V_{DS} = 3 V, I_{DS} = 10 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
500	0.992	-11.4	3.091	169.6	0.011	81.8	0.729	-6.9	0.13	31.25
1000	0.961	-21.7	3.045	159.3	0.022	74.6	0.721	-14.0	0.32	23.98
1500	0.985	-32.1	3.029	150.2	0.032	67.1	0.714	-21.0	0.12	27.96
2000	0.960	-42.5	2.941	141.1	0.041	59.8	0.709	-27.6	0.21	23.47
2500	0.930	-53.1	2.914	130.6	0.049	53.3	0.696	-34.1	0.30	20.85
3000	0.934	-61.7	2.795	123.1	0.056	46.5	0.687	-40.4	0.27	20.66
3500	0.885	-70.6	2.662	113.5	0.062	39.6	0.672	-47.1	0.44	17.75
4000	0.855	-81.8	2.568	104.4	0.068	34.7	0.657	-53.6	0.48	16.36
4500	0.876	-89.4	2.537	95.5	0.071	29.3	0.651	-59.9	0.42	16.80
5000	0.830	-97.3	2.436	88.7	0.076	23.4	0.637	-66.3	0.54	15.07
5500	0.818	-106.0	2.333	80.9	0.077	17.6	0.630	-72.4	0.58	14.37
6000	0.817	-111.4	2.251	74.2	0.080	14.0	0.623	-78.6	0.58	13.97
6500	0.786	-120.2	2.132	66.2	0.080	9.3	0.613	-84.7	0.70	12.80
7000	0.781	-126.4	2.100	59.2	0.081	5.9	0.619	-90.5	0.70	12.63
7500	0.772	-133.0	2.028	52.6	0.081	1.6	0.616	-96.0	0.74	12.14
8000	0.763	-140.2	1.988	44.9	0.079	-2.1	0.614	-101.6	0.78	11.82
8500	0.752	-145.6	1.929	39.3	0.082	-4.4	0.619	-106.8	0.78	11.42
9000	0.734	-152.9	1.854	31.6	0.080	-7.0	0.621	-112.3	0.87	10.84
9500	0.716	-158.2	1.815	25.8	0.079	-9.8	0.620	-117.7	0.95	10.41
10000	0.695	-164.0	1.758	20.0	0.081	-11.3	0.618	-122.7	1.01	12.83
10500	0.685	-169.5	1.714	14.1	0.079	-14.2	0.628	-127.7	1.06	11.85
11000	0.672	-174.5	1.666	7.7	0.079	-16.6	0.624	-133.5	1.13	11.00
11500	0.661	179.4	1.657	1.2	0.080	-18.3	0.624	-138.4	1.15	10.83
12000	0.649	174.4	1.624	-4.5	0.080	-19.6	0.633	-143.9	1.16	10.63
12500	0.633	169.1	1.597	-11.4	0.080	-21.6	0.629	-149.3	1.24	10.04
13000	0.614	162.3	1.577	-17.3	0.082	-24.0	0.638	-153.9	1.24	9.88
13500	0.594	156.9	1.542	-24.1	0.082	-24.4	0.646	-159.1	1.28	9.53
14000	0.567	151.1	1.500	-30.0	0.085	-27.7	0.651	-164.0	1.34	8.99
14500	0.543	143.5	1.483	-36.1	0.088	-28.7	0.662	-168.7	1.31	8.95
15000	0.536	138.2	1.462	-41.9	0.089	-31.6	0.668	-174.0	1.30	8.87
15500	0.512	131.0	1.455	-47.9	0.094	-34.7	0.670	-178.5	1.28	8.74
16000	0.489	123.7	1.451	-54.1	0.097	-37.3	0.679	176.3	1.24	8.79
16500	0.465	116.9	1.433	-60.5	0.100	-40.8	0.681	172.0	1.27	8.45
17000	0.451	108.3	1.441	-67.5	0.102	-44.1	0.688	167.4	1.22	8.67
17500	0.418	100.7	1.408	-74.6	0.106	-48.5	0.686	162.6	1.28	8.05
18000	0.387	91.9	1.404	-81.6	0.115	-52.0	0.690	158.2	1.22	8.06

Note:

1. Gain Calculations:

$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$. When $K \leq 1$, MAG is undefined and MSG values are used. $MSG = \frac{|S_{21}|}{|S_{12}|}$, $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}\,S_{21}|}$, $\Delta = S_{11}\,S_{22} - S_{21}\,S_{12}$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

NE67483B

V_{DS} = 3 V, I_{DS} = 20 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
500	0.999	-10.8	3.834	169.5	0.010	82.5	0.685	-6.8	0.00	00.00
1000	0.998	-21.9	3.746	160.0	0.020	73.6	0.680	-13.8	0.00	00.00
1500	0.996	-33.4	3.694	149.1	0.029	66.4	0.667	-20.9	0.08	34.72
2000	0.987	-43.8	3.630	140.2	0.037	59.9	0.663	-27.4	0.10	29.65
2500	0.968	-54.5	3.552	130.3	0.045	54.1	0.651	-33.8	0.16	25.48
3000	0.948	-63.8	3.417	121.7	0.052	47.6	0.638	-40.2	0.23	22.86
3500	0.923	-73.4	3.265	112.5	0.056	43.2	0.627	-46.7	0.28	20.76
4000	0.890	-84.3	3.107	103.1	0.062	36.6	0.612	-52.9	0.37	18.70
4500	0.885	-93.2	3.067	93.9	0.065	30.5	0.605	-59.3	0.38	18.37
5000	0.860	-100.9	2.929	87.3	0.067	26.0	0.592	-65.4	0.44	17.05
5500	0.840	-109.0	2.804	79.6	0.070	21.3	0.586	-71.3	0.49	16.09
6000	0.828	-115.7	2.694	72.9	0.071	18.9	0.580	-77.6	0.51	15.42
6500	0.811	-123.8	2.538	64.7	0.073	13.5	0.572	-83.4	0.59	14.45
7000	0.797	-130.5	2.500	57.9	0.073	10.6	0.578	-88.9	0.61	14.11
7500	0.776	-137.6	2.399	51.1	0.073	8.4	0.575	-94.2	0.68	13.34
8000	0.780	-144.3	2.349	43.6	0.074	5.4	0.575	-99.8	0.67	13.24
8500	0.754	-150.5	2.271	38.0	0.075	2.8	0.581	-104.8	0.73	12.56
9000	0.738	-157.3	2.175	29.9	0.075	0.5	0.584	-110.1	0.80	11.97
9500	0.720	-162.7	2.129	24.7	0.077	-1.9	0.582	-115.2	0.83	11.53
10000	0.693	-169.1	2.050	18.5	0.078	-3.4	0.585	-120.0	0.92	10.89
10500	0.677	-174.1	1.999	12.7	0.077	-5.5	0.591	-125.0	0.99	10.54
11000	0.661	-179.3	1.943	6.6	0.078	-6.6	0.593	-131.1	1.02	13.04
11500	0.649	174.6	1.923	0.1	0.080	-8.0	0.593	-135.6	1.03	12.69
12000	0.627	169.6	1.884	-5.8	0.081	-10.2	0.600	-141.0	1.08	11.95
12500	0.608	163.6	1.850	-12.6	0.083	-12.1	0.603	-146.5	1.12	11.43
13000	0.594	157.6	1.820	-18.5	0.086	-14.1	0.615	-150.9	1.09	11.48
13500	0.563	151.3	1.778	-25.2	0.087	-15.9	0.621	-156.1	1.15	10.74
14000	0.536	145.7	1.730	-31.3	0.092	-19.1	0.632	-160.9	1.15	10.42
14500	0.513	138.3	1.708	-37.2	0.095	-21.2	0.641	-165.7	1.14	10.29
15000	0.499	131.9	1.678	-43.1	0.098	-24.1	0.648	-170.8	1.12	10.24
15500	0.467	125.3	1.665	-49.4	0.103	-27.5	0.657	-175.2	1.11	10.10
16000	0.456	117.8	1.654	-55.4	0.105	-31.5	0.666	179.2	1.07	10.30
16500	0.426	109.8	1.636	-61.9	0.111	-34.6	0.668	175.0	1.08	10.01
17000	0.401	101.8	1.631	-68.8	0.114	-39.1	0.683	170.1	1.04	10.34
17500	0.373	92.7	1.599	-76.1	0.118	-43.4	0.679	165.3	1.08	9.58
18000	0.344	82.3	1.595	-83.0	0.125	-49.5	0.691	160.4	1.03	10.05

Note:

1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$$. When $K \leq 1$, MAG is undefined and MSG values are used. $$MSG = \frac{|S_{21}|}{|S_{12}|}$$, $$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}S_{21}|}$$, $\Delta = S_{11}S_{22} - S_{21}S_{12}$

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

NE67483B

V_{DS} = 3 V, I_{DS} = 30 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
500	0.999	-11.1	4.104	169.4	0.009	80.0	0.672	-6.7	0.00	00.00
1000	0.998	-22.3	4.015	159.5	0.019	75.6	0.665	-13.7	0.04	39.48
1500	0.991	-34.0	3.946	148.9	0.026	68.0	0.655	-20.9	0.08	31.92
2000	0.977	-44.6	3.862	139.7	0.035	60.4	0.650	-27.2	0.14	27.60
2500	0.962	-55.3	3.789	129.7	0.042	54.8	0.638	-33.7	0.18	25.13
3000	0.937	-64.9	3.621	121.3	0.048	47.9	0.625	-39.7	0.26	22.46
3500	0.909	-74.5	3.459	111.8	0.053	42.5	0.613	-46.4	0.34	20.41
4000	0.878	-85.4	3.291	102.7	0.057	38.0	0.599	-52.3	0.41	18.68
4500	0.870	-94.5	3.237	93.4	0.060	31.2	0.592	-58.8	0.43	18.21
5000	0.845	-102.2	3.087	86.8	0.062	26.8	0.579	-64.8	0.50	16.99
5500	0.824	-110.4	2.951	79.1	0.066	24.1	0.574	-70.7	0.54	16.07
6000	0.814	-117.0	2.830	72.4	0.066	21.3	0.568	-76.8	0.56	15.45
6500	0.793	-125.4	2.666	64.4	0.067	16.6	0.560	-82.6	0.65	14.46
7000	0.780	-131.7	2.622	57.5	0.069	14.3	0.566	-88.0	0.67	14.11
7500	0.759	-139.0	2.511	50.8	0.069	11.4	0.563	-93.2	0.75	13.38
8000	0.759	-145.8	2.456	43.2	0.069	9.2	0.565	-98.7	0.74	13.20
8500	0.738	-151.7	2.376	37.8	0.070	6.5	0.570	-103.8	0.80	12.64
9000	0.718	-158.5	2.271	29.7	0.070	5.1	0.574	-109.1	0.88	12.00
9500	0.702	-164.1	2.225	24.5	0.073	3.0	0.575	-114.2	0.89	11.64
10000	0.676	-170.0	2.139	18.6	0.073	2.6	0.577	-119.0	0.98	11.02
10500	0.663	-175.2	2.088	12.6	0.073	-0.1	0.585	-123.7	1.02	13.62
11000	0.644	179.6	2.029	6.4	0.076	-0.6	0.586	-129.9	1.05	12.92
11500	0.630	173.5	2.004	0.0	0.078	-2.4	0.584	-134.4	1.07	12.49
12000	0.613	168.6	1.958	-5.8	0.080	-4.6	0.595	-139.9	1.09	12.12
12500	0.594	162.7	1.930	-12.5	0.081	-7.0	0.599	-145.1	1.12	11.64
13000	0.577	156.7	1.890	-18.3	0.085	-7.6	0.608	-149.7	1.09	11.60
13500	0.549	150.2	1.850	-25.1	0.088	-9.6	0.616	-154.8	1.12	11.14
14000	0.523	144.3	1.800	-31.0	0.092	-13.3	0.626	-159.8	1.14	10.69
14500	0.496	137.0	1.772	-37.1	0.096	-16.1	0.638	-164.3	1.11	10.61
15000	0.486	131.1	1.741	-42.9	0.101	-19.4	0.645	-169.7	1.07	10.77
15500	0.455	123.6	1.733	-49.1	0.106	-21.7	0.653	-174.0	1.05	10.74
16000	0.439	117.0	1.718	-55.1	0.106	-26.2	0.664	-179.3	1.05	10.70
16500	0.416	108.5	1.693	-61.6	0.113	-30.1	0.668	176.2	1.03	10.68
17000	0.390	100.0	1.697	-68.5	0.118	-34.4	0.684	171.5	0.97	00.00
17500	0.364	92.3	1.654	-75.7	0.123	-39.2	0.679	166.8	1.01	10.78
18000	0.337	80.6	1.652	-82.8	0.129	-45.0	0.692	162.0	0.96	00.00

Note:

1. Gain Calculations:

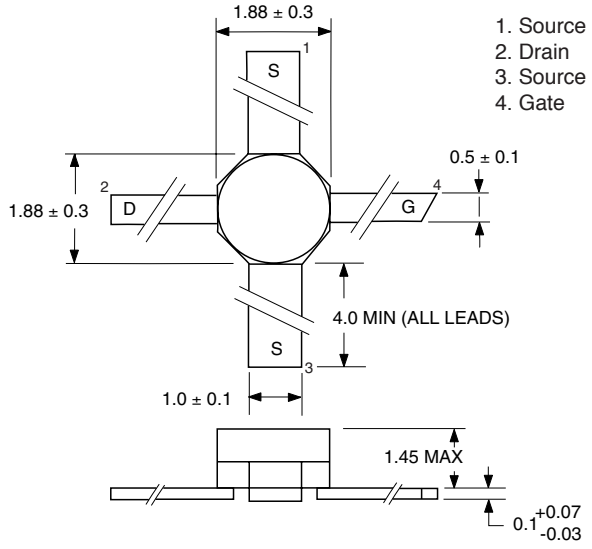
$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$. When $K \leq 1$, MAG is undefined and MSG values are used. $MSG = \frac{|S_{21}|}{|S_{12}|}$, $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}\,S_{21}|}$, $\Delta = S_{11}\,S_{22} - S_{21}\,S_{12}$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

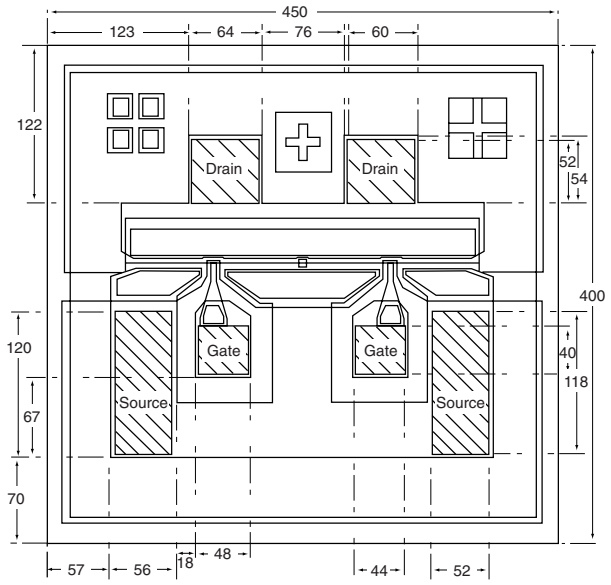
OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 83B



CHIP DIMENSIONS (Units in μm)

NE67400



Thickness = 140 μm

: Bonding Area

ORDERING INFORMATION

PART NUMBER	IDSS (mA)	PACKAGE OUTLINE
NE67400	20 to 120	00 (CHIP)
NE67483B	20 to 120	83B

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.